DOCUMENT RESUME

ED 120 781 CS 202 638

AUTHOR	Black, Colin
TITLE	Group and Individual Study of Programmed Language Materials: A Pilot Study. No. 16.
INSTITUTION	Turku Univ. (Finland).
PUB DATE	75
NOTE	66p.; Not available in hard copy due to marginal legibility of original document, Report from the Institute of Education
EDRS PRICE	MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS	*English; *Group Instruction; Higher Education; *Individual Instruction; Instructional Materials; *Language Instruction; Language Research; Pilot Projects; Programed Instruction; *Programed Materials; Teaching Methods

ABSTRACT

Two study modes from the paradigm of research into group-study variables are considered in the present investigation. It was hypothesized that the achievement of subjects studying langauge materials with a high proportion of familiar matter (practice and revision programs) will be greater in a condition of group-study with interaction, and achievement of subjects studying langauge materials with a high proportion of unfamiliar matter (new learning) will be greater in a condition of individual study in isolation. Subjects were taken from a population of first-year university students following a course of self-instruction in English. In the grammatical structures and listening comprehension areas, group-study subjects showed significant superiority over the individual study subjects, confirming the first hypothesis. In the intonation area, individual study subjects did not show any superiority over group-study subjects, thus the second hypothesis was not confirmed. A limited attitude study gave some indication of more favorable attitudes towards instruction in the group-study subjects. An experimental design, linked to attitude study, is proposed for further investigation of the problem. (RB)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

ED120781

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

REPORT
from

THE INSTITUTE OF EDUCATION
UNIVERSITY OF TURKU

COLIN BLACK

GROUP AND INDIVIDUAL STUDY OF PROGRAMMED LANGUAGE MATERIALS: A PILOT STUDY

BEST AVAILABLE COPY

US 2.02 638

No. 16
1975

ISBN 951-641-280-7

Institute of Education
Head: Prof. Juhani Karvonen
Address: University of Turku
Finland

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION 1
   1.1. Significance of the problems of the present investigation 1
   1.2. Review of previous research on group work in language teaching 5
   1.3. Review of previous research on group and individual study of programmed materials 17
   1.4. Hypotheses of the present investigation 23
   1.5. Definition of central terms 23
2. METHODS 25
   2.1. Experimental design and statistical methods . 25
   2.2. Programmes 27
   2.3. Media 28
   2.4. Instructional environment 29
   2.5. Administration 29
   2.6. Teacher participation 32
   2.7. Tests 32
   2.8. Measurement of attitude 35
3. RESULTS 37

SUMMARY 53

REFERENCES 56

LIST OF TABLES

1. Pattern of responses in phase 2 (Heuser & Messelken 1968) 15

2. Ratio of corrections made to incorrect responses made (Heuser & Messelken) 16

3. Characteristics of Grammatical structures test, autumn 1971 33

4. Characteristics of Listening comprehension test, autumn 1971 33

5. Characteristics of Intonation test, autumn 1971 ... 34

6. Intercorrelations of the three tests 34

7. Grammatical structures: analysis of covariance of post-test scores with pre-test scores as covariates 37

8. Duncan's New multiple range test applied to the differences between adjusted means for Grammatical structures 38

9. Listening comprehension: analysis of covariance of post-test scores with pre-test scores as covariates 39

10. Duncan's New multiple range test applied to the difference between adjusted means for listening comprehension 40

11. Intonation: analysis of covariance of post-test scores with pre-test scores as covariates 41

12. Duncan's New multiple range test applied to the difference between adjusted means for Intonation 42

LIST OF FIGURES

1. Communication structure of the traditional language classroom (After Messner, 1968, simplified 7

2. Decentralized, reciprocal communication structure of the "conversation lab." after Messner, 1968, simplified 8

3. Paradigm for the learning of new material in the investigation of Bauer, 1964 13

4. Paradigm for the revision of already learnt material in the investigation of Bauer, 1964 13

5. Paradigm of research into group study variables in programmed instruction 22

6. Grammatical Structures: distribution of pre-and post-test scores 39

7. Listening Comprehension: distribution of pre-test and post-test scores 41

8. Intonation: distribution of pre-test and post-test scores 43

9. Matched pairs design for the investigation of effect of interview 51

10. Design of a two-factor experiment with repeated measures on Factor B (study mode) 51

11. Analysis of variance on post-test scores in the two-factor experiment 52

1. INTRODUCTION

The present investigation concerns one of the variables relevant to the use of programmed materials in the language laboratory. However, its findings may be expected to have a wder significance for language teaching, since the variable concerned - the effect of group study - is relevant to language teaching generally, in the classroom or in the language lab.

The questions posed by the study are:

1. Is a certain type of programmed language material, namely that featuring essentially new learning, better suited for individual study than for group study?

2. In another type, namely that featuring practice or revision of already learnt material, better suited for group study than for individual study?

1.1. Significance of the problems of the present investigation

The problemsof the present investigation are studied here in terms of a particular medium of instruction, the language laboratory. This is for three reasons. Firstly, the commonly available types of lab. allow a clear differentiation of the study modes under investigation. Secondly, use of the lab. makes it possible to study complex group effects without the additional complication of a teacher's presence. Thirdly, investigation of the characteristics of this teaching medium is valuable per se, since this equipment is frecuently used without any reasoned instructional strategy.

However, the question of group work with which this study is concerned should be a relevant one for the language classroom also. It would appear, nevertheless, from the infrecuent reference to this mode of study in the language teaching literature and from the limited scope accorded it in textbooks of language didactics (e.g. Rivers, 1968; Chastain, 1971) that group study is not a commonly

adopted technique in the foreign language classroom. This contrasts strongly with the situation in some other subjettfields, notably science, where learning in groups is a widely used classroom technique. The neglect is paradoxical, because language can be considered the very field where group work is most natural and relevant. For language is distinguished from other subject fields in being itself a medium of communication. The goal of second language instruction is, or should be, the mastery of a particular medium for the purpose of communicating.

This commonsense view has not always been widely endorsed by the language teaching profession, but there are signs that it is gaining support. Oller (1971), for instance, reviewing a conference of applied linguistics, concluded:

> "I believe that it is safe to conclude that there is fairly general agreement that the basic goal of foreign language teaching is to enable the student to succesfully send and receive messages in the foreign language; that the necessary and sufficient means for achieving this objective is to involve the student in active communication in the target language. The sooner, the better." (Oller 1971, p. 177)

It is a consequence of this view of language that instruction and practice in a foreign language should feature active communication, a sender and a receiver. This is amply available in group study, but only artificially available ("talking to the teacher") in classroom practice. It is an even greater artificiality in individual work with programmed materials in the language lab. ("talking to the tape", "talking to oneself"). This conflict between the language lab. situation and the communicative function of language has been resolved in favour of the lab. by those writers who have, tacitly or explicitly, excluded communicative activity from language teaching. Morton, for instance, an early proponent and author of language teaching programmes, used, for individual instruction, materials that actually <u>suppressed</u> meaning and communication. For example, in his Spanish programme, all the sounds of the language were taught to a high degree of mastery before the learner know the meaning of a single Spanish word (Morton 1960; M 1965)

This teaching strategy, like the related "Audio-lingual method", should be seen in the context of American linguistics, which for

decades (e.g. Bloomfield, 1933; Harris, 1951Chomsky, 1957, 1966) has considered language as a closed system, i.e. apart from any actual communicative situation. The inadequacy of the closed-system model of language has been criticised in many quarters, and a large body of experimental evidence against it has been brought forward by Paivio (1971).

The design of the language lab. has also been a factor discouraging communication and group work in language teaching. This apparatus was developed within a conceptual framework of structural linguistics and behavioral psychology. For this reason, early labs. characteristically featured sound-proof, isolated booths communicating visually only with a teacher's console or, in some cases, only with a projection screen. Audio communication took place, if at all, between teacher and student individually, the purpose of the communication being monitoring, its tone varying from advisory and encouraging to disciplinary. Teaching materials used were predominantly structural drills designed to make sentence patterns into "linguistic habits" and characteristically having a low emphasis on meaningfulness (Brooks, 1960; Lado, 1964).

There has been increasing criticism of the whole approach to language teaching that established the use of the language lab. described above. This criticism has come from two main quarters.

1. Transformational-generative linguistics, beginning with Chomsky's (1959) review of Skinner's Verbal behavior (1957), in which he attacked the "habit formation" basis of language learning which is associated with the Audiolingual model. The influence of this school of linguistics upon language teaching can be seen in criticism of the Audio-lingual method's preoccupation with the mastery of surface-structure phenomena, e.g. phenomes and sentence patterns (Spolsky, 1966; Oller & Obrecht, 1968).

2. Psychology of learning, with articles by Ausubel (1964) and Carroll (1966), who pointed out that practices of the Audio-lingual method were at variance with several well-established principles of learning, in particular the preference of the method for analogy compared to analysis, its use of unvarying drills on single patterns, its employment of only one sense modality (hearing) and its low emphasis on the learning of meaningful material.

These criticisms were reinforced by the findings of the large-

scale Pennsylvania Project (Smith, 1970), which found that the Audio-lingual method was not more effective than the traditional grammar-translation method. The findings of the project signalled a change in approach to language teaching generally (Carroll, 1969; Mueller, 1971) that has been mirrored in changes in the use of the language lab. In particular, installations without facilities for individual recording and playback, the so-called "audio-active" lab., are now built without sound-proofing isolation. Technical extensions of this development are the "wireless" lab. (Stack, 1969) and an umbrella-like arrangement of headsets suspended above the students' heads, sometimes called the "electronic classroom", though in fact this term has many referents (Smith, 1969). These non-isolating installations make the question of group work in the language lab. highly relevant.

At the same time, the role of the teacher as "drillmaster" in the record-playback lab. is currently being questioned (Ager, 1970; Dung, 1971). Indeed, except as a disciplinary or motivating agent, it is not easy to clarify the teacher's role in the record-playback lab., if students are working with self-instructional materials. A consequence of this uncertainty is that record-playback equipment is frequently used exclusively for "library" work.

These development within the technology and methodology of language teaching have created a situation where the question of group work versus individual work, with which the present investigation is concerned, needs clarification. The following language lab. situations represent discrete individual or group study conditions:

1. Library work in the record-playback lab. is a case of individual study, provided there is no supervision and the is not working in a group.

2. If the student is working simultaneously with others in a library session, the situation is one of group study in coaction.

3. If a teacher is supervising a "lock-step" session in either a record-playback or audio-active lab., the situation is one of group study in coaction under supervision.

4. If small groups are working together with audio-active equipment without isolating booths and are communicating with one another, the situation is one of group study in interaction.

((For definition of terms, see Section 1.5.)

The present investigation integrates into the study of two of the above situations or study modes, namely individual study and group study in interaction, the two types of installation that correspond to these modes:

the record-playback lab. used for individual, non-supervized study

an audio-active lab. without isolating booths used for group study in interaction.

1.2. Review of previous research on group work in language teaching

Despite the central role of communication between persons in the human activity that is the subject of foreign language teaching, little attention has been given in the literature of language teaching to work in small groups as a method of learning practising language. Even in the few available references, communication within the group is not always presented as an aspect of lanuage use; instead, the heightened motivation associated with work in interacting groups is given as the justification of the method.

Polak (1964) reported favourable experience with group work in written composition. The situation was one of free interaction in a small group, with the aim of producing a composition in the foreign language as a community project. Members of the group made suggestions on word choice, grammar, etc., which were accepted or rejected after discussion. Students appeared to show favourable attitudes towards this community writing. Similar experiences are reported by Forrester (1965).

It can be noted that the methodology used by these teachers does not derive from the nature of the subject matter. The students are doing no more here than carrying out a school excercise in a community situation; the subject of the excercise could be anything. In other words, although communication is taking place between members of the group, this communication itself is not the object of instruction.This would be the case with the area of language instruction concerned, namely writing, only if members of the groups were writing meaningful communications to each other.

This failure to link small-group work with the nature of language as a communicative activity is even clearer in the suggestion of Matthes (1969). Teaching English in a German high school, this author used groups of four to practise grammar and reading aloud (pronunciation). The dynamics of the group were provided by competition for leadership. The leader of each group acted as a small teacher, apparently performing precisely the same role in the group as the teacher in the whole class, i.e. assigning tasks and correcting mistakes. Matthes himself did not refrain from interfering when he heard a mistake of pronunciation not corrected by the leader or made by the leader. If the mistake seemed serious enough, Matthes would interrupt the work of all groups and call for chorus work (drill) on the point of pronunciation concerned. There was no communication in the foreign language. The flavour of the work is conveyed by the following instruction, to be given by the group leader:

> "Wiederhole die Stammformen folgender unregelmässigen Verben - mit deutscher Bedeutung."
>
> (Matthes, 1969, p. 35)

Mengler (1972) presented a method of guided conversation in small groups that comes much closer to a communication situation, but which remains very much bound to the classroom exercise tradition. The situation was a dialogue game in small groups, using previously learned model dialogues and a flannel board as a stimulus for new items. Formalised dialogues were built up by pairs, rotating around the group. Dynamics were provided by competition: if B cannot respond to whatever A has produced, C intervenes and takes over.

In contrast to Matthes, Mengler was careful not to interfere in the group activity. No controlled observation or evaluation was made by either Matthes or Mengler, but both reported heightened motivation and activity.

A proposal to systematically integrate small-group work with classroom practice was made by Messner (1968), (1968, who presented a communication model for the language classroom. His argument for a communication model of interaction in small groups is principally based on a time calculation: if each student is allowed to speak (to the teacher) for one minute in each lesson, he will have spoken for a total of eight hours after completing four years'

study at school. This is not early sufficient to develop fluency in speaking. Also, the ratio of speaking time to time spent in other activities (1 : 49 in a fifty minute lesson, each student speaking for one minute) does not correspond to the importance laid on this ability in many official statements of language teaching objectives.

Messner's representation of the communication structure of the the traditional (frontal) language classroom is displayed in figure 1.

Figure 1. Communication structure of the traditional language classroom (After Messner, 1968, simplified)

In Figure 1, the teacher is engaged in a two-way communication with one student, while the others do not participate in the communication. In contrast, Messner proposed an interaction structure in pairs for at least part of the language lesson, that part which is devoted to oral practice. He calls this structure the "conversation lab." (Figure 2).

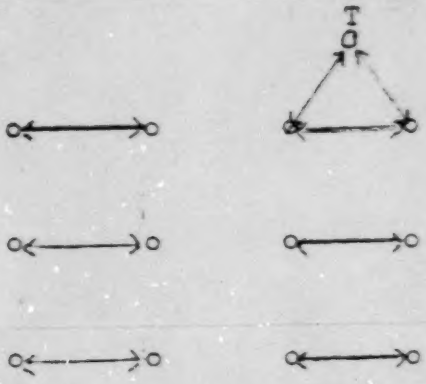


Figure 2. Decentralized, reciprocal communication structure of the "conversation lab." after Messner, 1968, simplified

All students here are participating in communications. As the teacher moves from pair to pair, he institutes a three-way communication. Messner notes that if only a small portion, say a fifth, of the total lesson time is devoted to this technique, the speaking practice of each student is enormously increased as compared to the frontal situation.

Messner conducted an enquiry after three weeks of practice with this model in an American college. Of the students interrogated, 86 per cent claimed to have noted an improvement in their own speaking abilitywhile 93 per cent were of the opinion that noise generated in the classroom by the technique was not disturbing.

Even more rare than small-group work in the language classroom is group study in the language laboratory. The design of the traditional language lab. has douptless been a severe deterrant to the introduction of small group methodology to this learning environment, featuring as it does soundproof isolation, restricted visual communication and individual cubicles. These barriers to communication, however, did not discourage Bung (1967) from trials with three-way communication in the language lab.

Bung reported succesful experiences with group work in the language lab. with three students per group using a single tape-deck fitted with three-pole sockets. The third student in this arrangement is a leader, who is responsible for maintaining flow of conversation. Conversations are recorded, which allows students to concentrate on fluency, rather than accuracy, while speaking. The finished recording is discussed for accuracy with the teacher. Bung advises the teacher not to participate during the conversation stage;

the recording, however, is subjected to a close "tape analysis" by teacher and students, students discuss the same subject again, perhaps with the groups re-arranged to maintain interest. The author has presented no experimental findings, but claims greatly heightened motivation for his method.

A coaction situation in the language lab. without teacher interference was reported by Schommartz (1972). Here students participated voluntarily in after-school work sessions, "Arbeitsgemeinschaften", in the language lab. of a German high school. Students proceeded at their own pace through programmes that were sent to the whole group from a central source and recorded for individual study. Teacher participation was discrete: there was no monitoring, and help was given only when asked for.

No systematic evaluation of this study mode was attempted, but favourable attitudes and good motivity are reported. The situation differs both from"library study", since students all work on the same programme, and from frontal language lab. teaching, because of the voluntary activity and the teacher's reticence. It appears to represent a well-defined coaction situation that could be integrated into an experimental comparison of group conditions.

Although small-group work is a rarity in language lab. practice, the term group work has long been used in connection with certain kinds of language lab. equipment. The early 60's witnessed a debate between advocates of "group work" using so-called "broadcast equipment" (audio-active installations without recording facilities)"and individual work" using so-called "library equipment" (installations with full facilities for recording and playback. In fact, as both types of equipment were intended to be used for frontal teaching, the question of individual study did not arise. What was concerned were two different forms of group activity, as defined above(p. 4)

In spite of the well-known individualizing concepts of programmed learning - that the student should select his own pace, dwell on points he finds difficult, etc. - several authorities on the language lab., e.g. King, Mathieu & Holton, (1961), Freudenstein (1965) (1965), advocated the use of broadcast equipment without facilitiesfor individual recording and playback. The

pedagogical arguments for the preference (there are economic considerations also, as broadcast equipment is as much as four times cheaper than library equipment) were:

1. Students can interfere with the rhythm and pace of the programme, can break up the lesson into small pieces and can take up to two or three times longer in making their responses than the teacher had envisaged (King, Mathieu & Bolton, 1961).
2. Most lab. work in schools takes place in junior classes. Students at this level are not able to correct their own errors, so that individual playback is not appropriate (Freudenstein, 1965).

Both of these arguments contain an implicit preference for the conditions of frontal classroom instruction, in which the teacher maintains the pace of the lesson, notes and corrects all errors. The first argument against the use of library equipment could in fact be used by advocates of programmed learning as an argument for this equipment. The same argument reveals that the American authors believe that the attainment of fluency in a foreign language is dependent on rhythm and pace in practice. This implies a mechanistic concept of language acquisition.

Freudenstein's argument contains assumptions about the student's capacity for individual work which may be inseparable from frontal classroom practice. That is, if in a particular tradition the student is typically given no opportunity for self-evaluation, he will predictably reveal himself incapable of self-evaluation.

Freudenstein's (1965) advocation of broadcast equipment provoked some debate in the German literature. Freudenstein had supported his view with the technical data, later disproved, that the presence of recording equipment in the student's booth causes inferior reception. The belief was also expressed by this author that students in junior classes could not handle electronic equipment of this order of complexity.

Wisnikow (1965) attacked both these assumptions, correctly prophesying that equipment both would become simpler and would allow much higher fidelity of reception, but also arguing that the student's capacity for self-evaluation woul

increase with more opportunity for self-evaluation. Keil (1966), supporting Freudenstein, suggested that Wisnikow had no experience of classroom conditions, an observation that may suggest that teachers in this period were endeavouring to use the language lab. as a frontal classroom.

This debate is interesting for its total disregard of central issues of group and individual study conditions. A striking question, for instance is whether isolating booths can be justified in work with broadcast equipment, as this feature of the equipment appears anomalous in a group-learning situation.

Empirical studies

Empirical studies of the language lab. have generally ignored the social aspects of the learning situations created by the medium. Nevertheless, social effects have of cource been present in the situations investigated. For this reason, it is profitable to examine studies of the effectiveness of language lab. equipment in order to see if any information on the social variables has been found or suggested in these studies.

Bauer (1964) Two groups of twelve individuals were matched on intelligence, linguistic scores in the American Council of Education psychological Examination and sex. The subjects were second-year U.S. college students of German.

The research problem was defined as an attempt to determine:

> "whether the language laboratory program should be supervised (group program) or not; and if so, how much and when the group program should be preferred to individual work."
>
> (Bauer, 1964, p. 100)

Accordingly, the experimental treatments were"supervised group" and "unsupervised individual". The hypothesis was that:

> "in language laboratory training, supervised groups will do better than unsupervised individuals."
>
> (Bauer, 1964, p. 102)

The supervised condition had both an instructor and a "roving assistant" who checked and assisted students during group study sessions. Neither instructor nor assistant was present

during the individual sessions, but students recorded on a time sheet in the lab. times they entered and left the lab. There was a time requirement for the course (three fifty-minute classroom sessions and two fifty-minute lab. sessions in one of the two study conditions per week).

The study used the alternate groups method to investigate the effect of treatments. Both groups studied the same materials for three and a half weeks. Then, after a twenty-two-day interval the groups switched treatments and then studied the same materials as before, this time for two and a half weeks.

The fact that the same material was used in the second half of the study has introduced a complication not noted by the author. In the second half, the experimental groups were engaged on revision, not new learning. However, each group had previously studied the material under the opposite condition.

Language lab. equipment was the same for both groups, but time of exposure to the materials was not the same, since the unsupervised individuals in the first three and a half weeks attented the lab. only 89.9 per cent of the required time, compared to 99.1 per cent attendance by the supervised lass.

The results of the experiment were that a superiority was found in the first period for the supervised-group treatment in respect to oral-sural components of the course (dialogues and structure practice, dictation). No differences were found in respect to written work. With treatments reversed in the second half, no significant differences were found for any components of the course.

This study involved considerable complexity. What in fact was being studied? Figures 3 and 4 present paradigms of the research areas implicit in the design. It will be seen that only a small number of these areas were actually taken into consideration.

	GROUP	INDIVIDUAL
SUPER-VISED	X	
NOT SUPER-VISED		X

Figure 3. Paradigm for the learning of new material in the investigation of Bauer, 1964

The crosses in Figure 3 indicate the parts of the paradigm actually studied by Bauer. Supervised individual work and unsupervised group work were not studied.

	Previous learning in supervised group		Previous learning as unsupervised individual	
	GROUP	INDI-VIDUAL	GROUP	INDI-VIDUAL
SUPER-VISED			X	
NOT SUPER-VISED		X		

Figure 4. Paradigm for the revision of already learnt material in the investigation of Bauer, 1964

The crosses in Figure 4 again indicate the two parts of the paradigm that were studied by Bauer. The figure is in fact simpler than it could be, for it would be possible to have done previous learning in the conditions of unsupervised group and supervised individual. This would mean a paradigm of sixteen compartments.

This study highlights the decisive importance for motivation of external assistance (supervision, monitoring, advising) in work with programmed materials. This is a variable that must be equated when comparing treatments.

Wouser & Messelken (1968). Two equated groups of ten primary school children were used in an experiment to determine whether record-playback equipment was demonstrably superior to audio-visual equipment. Groups were equated on acievement and sex.

Two research problems were formulated:

1. Is the record-playback lab. superior to the audio-active lab.?

2. Does hearing responses made simultaneously by one's companions adversely affect work in the audio-active lab.?

In order to approach the second of these questions, students in the record-playback lab. were seated well apart from one another, allowing no acoustic contact, while group responses in the audio-active lab. were clearly heard by all individuals, a "chorus effect".

Eight sessions of lab. work took place, twenty to twenty five minutes in length. Four programmes were worked through in the course of these eight sessions, each programme dealing with a grammatical structure that was taught concurrently in the classroom. In programmes 2 to 4 four-phase structure drills were employed, and these three programmes were the source of the data of the study.

The four-phase drill has the form: 1. cue, 2. student response, 3. model answer, 4. student imitation.

As data collection, a count was made of errors made in phase 2 (student response) and phase 4 (imitation of model response). It is not clear how this observation was carried out, and it would be of great interest to know this . It would seem essential for accurate observation in these language lab. conditions to have as many observers present as there was students. The presence of a large number of observers, however, would create a highly special situation for the learners and one that could not be generalised to school practice.

The authors note that overall fewer errors were made in

phase 2 by the audio-active group. In fact, perusal of the breakdown of scores on each programme, given in Table 1, shows that this superiority was present only in the case of programme 2, the first programme studied. In the two subsequent programmes, the audio-active group made slightly more errors. None of these differences is significant, however ($p > .05$).

Table 1. Pattern of responses in phase 2 (Heuser & Mosselken, 1968).

Stimuli	Correct		Incorrect		%	
	R	A	R	A	R	A
(2) 320	224	244	96	76	30	23.8
(3) 360	210	205	150	155	41.7	42.1
(4) 351	245	243	106	108	30.2	30.8

R = record-playback

A = audio-active

Another interesting detail here is the effect of difficulty in programme 3. The authors give no attention to the comparison between performances on programmes 2 and 3, but this may have been the crucial observation of the study. During work on an easy programme, with correct responses to more than 70 per cent of items, the audio-active group made fewer errors. In a more difficult programme with correct responses to less than 60 per cent of items, this group made slightly more errors. There is not enough information supplied in the report to justify an interpretation of the tendency, but two suggestions could be made:

1. the effect of connection is to enhance performance in well-learned responses (Zajonc, 1965)

2. the kind of information given by one's companions affects the quality of performance in a situation where all responses are audible. That is, where many incorrect responses are heard, performance is inferior.

To test whether the chorus effect had a detrimental effect on the audio-active group, the number of corretions made in phase 4 were counted, as were the total number of correct responses made in this phase. The authors neglect to furnish the most relevant information here, namely the ratio of corrections made

to incorrect responses in phase 2. These calculations are presented in Table 2.

Table 2. Ratio of corrections made to incorrect responses made (Heuser & Messelken, 1968)

Programme	Incorrect responses		Corrections made		%	
	R	A	R	A	R	A
2	96	76	79	66	82	82
3	150	155	107	110	72	71
4	106	108	83	93	78	86

The observation of interest here is that in the final programme, programme 4, the audio-active group made percentually more corrections than the individuals did. Again, the difference is not significant at .05, but a longer experimental period and inquiry into student attitude would have revealed whether this tendency was attributable to higher activation the group.

The authors' own conclusion is:

> "Offenbar achten die Kinder auch in HS-Labor stärker auf die Lehrerstimme als auf die Stimme ihrer Nachbarn."
>
> (Heuser & Messelken, 1968, p. 49)

The study does not provide evidence to justify this conclusion. It may, on the contrary, have been precisely the effect of hearing their neighbours correcting their responses that accounted for the difference in question.

The general conclusions of the authors are:

1. The record-playback lab. does not produce heightened achievement and is thus not worth the extra cost at primary school level.
2. Chorus work does not adversely affect performance.

To be able to draw the first conclusion with any confidence, one would have to take a different measure than that used in this study. Namely, it would be necessary to give an achievement test after work on the programmes. A test of retainment would also be appropriate.

An interesting question not asked by these authors is, how

does audible group responding affect achievement on a variety of language learning tasks?

Social factors may have been active in the studies of Lorge (1964) and Mueller & Wiersma (1967a, 1967b), who compared achievement with different types of electronic equipment. Unfortunately, these authors give no details of the learning situation, teaching materials, administration, teacher participation, or type and functioning of equipment.

A study with direct relevance to the problem of small-group work in the language lab. is that of Smith (1969). Smith hypothesized that the motivating effect of physical contact with fellow students would mean a superiority for a type of audio-active lab. which he calls the "electronic classroom" over the record-playback lab with its isolating booths. Smith's electronic classroom was a free classroom space with electronic equipment suspended above the students' heads and pulled down by them when required.

Contrary to the author's expectations, no significant differences were found between treatments in tests of speaking ability, but in two of three experiments in the study there were significant differences in favour of the record-playback groups in listening comprehension. Unfortunately, a methodological error makes Smith's results difficult to interpret satisfactorily: the electronic classroom groups were given less working time than the record-playback groups.

1.3. Review of previous research on group and individual study of programmed materials

The effects upon learning of studying in a group have been the subject of a number of studies using both human and animal populations. These effects, first studied by Triplett (1897), were given considerable attention in the 1920's and 30's, the work of Allport (1920) being the most encompassing.

Unfortunately, before very much explanation of group effects, or "social facilitation" (Allport, 1924), had been put forward, the subject was abandoned in the pre-war years and has only recently been taken up again,, notably by Zajonc (1965, 1966). It

is presumably for this reason that the notion of social facilitation has not found a place in the numerous investigations of the group study of programmed materials that have been carried out in the past decade.

That group study should be seriously considered within the context of programmed learning may seem anomalous in the light of certain "principles" of programmed instruction enunciated by Skinner (1966) and others, e.g. individualisation of study and self-pacing. However, such "principles" have long been seriously questioned.

Investigating the principle that self-pacing is essential for the effective study of programmed materials, Frye (1960), Silverman & Alter (1961), Feldhusen & Birt (1962), Heimer (1963), Greenhill, Lottes & Pagano (1963), Lottes, Palmer & Oakes (1963), Dodd (1965), Lewis (1965), Moore (1967) and the National Centre for Programmed Learning (1968) found no significant differences between individually and externally paced instruction. Gallegos (1960) is the only author to date to have found a superiority for individually paced instruction, and this only in respect to subjects of very high and very low ability. Cropper & Kress (1965), on the contrary, found external pacing superior. These authors also found that many students were unable to find an optimal individual pace.

Attitudes towards external and internal pacing were studied by Brown (1965), Allan & Richardson (1967) and the National Centre for Programmed Learning (1968), who found more favourable attitudes shown towards externally paced instruction, and by Lottes, Palmer & Oakes (1963), who found no difference in attitude. That external pacing achieves significant time gains has been shown by Frye (1963), Lottes, Palmer & Oakes (1963) and Moore (1967).

These studies, most of them dating from the early 1960's, laid the way for comparisons of group study versus individual study and of work in pairs versus individual work in programmed instruction. These investigations, however, have produced apparently contradictory findings.

A superiority for the group study of programmed materials

was reported by Oldfield (1964), Crist (1966), Mirzal (1969) and Strittmatter (1971). On the other hand, findings favouring individual study were made by Meisler & McNeil (1962) and Jones (1964), while Hulteen & Crist (1969) found a difference in favour of individual study only in high ability groups. Feldhusen & Birt (1962), Spencer (1963), Sawiris (1966a), Fellows & Apter (1967) and Heyman & Boeckmann (1972) found no differences, except that the last-mentioned authors found a significant difference in time in favour of group study.

Individuals and pairs have been compared by Dick (1963), who found superior retention after one year by the pairs, but no significant differences in initial achievement on the final test, and by Noble (1967), who found no difference in either attitude or achievement except on the most difficult components of the course, where individual study was superior. Austwick (1965) and Sawiris (1966b) found no difference in achievement, but Austwick's time results favoured pairs.

Amaria, Biran & Leith (1966, 1969a, 1969b) found a superiority for different-ability (heterogeneous) pairs over similar-ability (homogeneous) pairs and individuals. This result was not supported by the studies of Hartley & Cook (1967), Hartley & Hogarth (1971) and Hogarth & Hartley (1973), nor in a subsequent study by Amaria (1967).

To date, studies have not attempted to elucidate the nature of the group involved or to observe what happens within the group in cases where superiority is claimed for group study. Reports frequently fail to mention what the group does or what conditions it works under. It is not even clear in all cases what is meant by "individual" study. This question of definition will be taken up below.

It is of interest that studies of group and individual work in programmed instruction have regularly used programmes intended for individual study. Both Oldfield (1964) and Crist (1966) used programmes specifically designed for group study and both found a superiority for group work.

This whole body of research seems to have been carried out without reference to the earlier work on group effects mentioned above. This may be due to the apparently ambiguous results achieved

by Allport and other investigators, who found that individuals achieved better in a group on certain tasks and better in isolation on other tasks. However, a consistency in these results was pointed out by Dajong (1965, 1966), which has important consequences both for the interpretation of the hitherto ambiguous results on the group study of programmed materials and for the planning of further research in this field.

Dajonc noted that where the individual learner's achievement was greater either in front or an audience (e.g. in the studies of Travis, 1925 and Dashiell, 1930) or in coaction with other individuals (Allport, 1920), the learning tasks concerned always involved familiar, well-learned responses.

Thus, Travis and the learning of a rotary pursuit task and Dashiell simple multiplication tasks and word association, while those experiments of Allport's which showed superior group performance involved chain word association, cancelling the vowels of a text, reversible perspective and multiplication.

Summary:

Tasks involving familiar, well-learned responses	ROTARY PURSUIT MULTIPLICATION CHAIN WORD ASSOCIATION VOWEL CANCELLATION REVERSIBLE PERSPECTIVE

In contrast, studies which showed individuals learning better in isolation than in front of an audience (e.g. Husband, 1931; Pessin, 1933) or in a coaction situation (Allport, 1920) used tasks that involved the acquisition of new responses.

Thus, Husband used a finger maze, Pessin nonsense syllables and Allport, in the two of his six experiments that favoured learning in isolation, the solving of logical problems and the judgement of odours and weights.

Summary:

Tasks involving acquisition of new responses	MAZE LEARNING NONSENSE SYLLABLES LOGICAL PROBLEM SOLVING JUDGEMENT TASKS

This pattern of consistency has been followed in animal studies, which have shown that social facilitation is effective when instinctive behaviour is involved, whereas learning is more effective in isolation when new responses are to be acquired, as in maze learning. It is also known from animal studies that amount of activity (e.g. eating, nest-building) increases in a coaction situation (Zajonc, 1965, 1966).

In review, the consistency in research into social facilitation noted by Zajonc is that both the presence of an audience and coaction with other individuals facilitate performance of well-learned responses, whereas the learning of new responses is best achieved in isolation.

This insight has the following consequence for programmed instruction. Research into the group study of programmed materials must use a paradigm that, in the first place, distinguishes between new learning and the rehearsal of previous learning and, secondly, explicitly and adequately defines individual and group study.

Before such a paradigm can be presented, a further category of group behaviour must be mentioned, in addition to behaviour in front of an audience and coaction, namely interaction. Four categories, then, must be distinguished.

1. study in isolation
2. study in front of an audience
3. study in coaction with other individuals
4. study in interaction with other individuals.

Across these variables, one must consider at least two categories: study with an emphasis on new learning, study with an emphasis on rehearsal of previous learning. Figure 5 combines the four study mode variables and the two learning task variables in a paradigm of research.

It must be noted that the category of interaction is not a simple one. The many possible differentiations of group processes bearing this name are indicated in the work of Bales (1960). Research comparing interaction with other conditions should clarify what type of interaction is involved. Studies of programmed learning in pairs, typically an interaction situation, have often failed to report on this. Sutter & Reid (1969), for instance, comparing work on a CAI programme in isolation and in pairs, gave no indication of what the pairs did. It can be said that nearly all

studies on work in pairs in programmed instruction have reported unsatisfactorily on this important aspect of the work.

	STUDY IN ISOLATION	STUDY WITH AUDIENCE	STUDY IN COACTION	STUDY IN INTERACTION
Imphasis on new learning (presentation of new information)				
Emphasis on performance (rehearsal of previous learning)				

Figure 5. Paradigm of research into group study variables in programmed instruction

Specification of the nature of the interaction involved is particularly crucial in studies of personality variables in programmed learning in pairs (e.g. Amarin, Biran & Leith, 1969b; Butter & Reid, 1969). If conclusions are to be made on the effect on work in pairs of degree of anxiety, sociability, introversion, etc. in one or both members of the pair, it must be made clear what type of interaction and how much interaction took place between the members. Observation of groups at work, using the categories established by Bales, is a suggestion for future research into programmed instruction in pairs and small groups.

At this stage, it would be fruitful to review the literature on the group study of programmed materials in terms of the paradigm of Figure 5. For two reasons, this is not possible. In most cases, it is not possible to form any judgement on the emphasis on learning or on rehearsal in particular programmes used in the studies. Further, it is apparent in many studies that no distinction has been made between individual work in isolation and work in a coaction situation, both being called "individual work". Other studies confuse coaction and interaction, both being called "group work". In some reports, failure to provide adequate information on study conditions makes it impossible to determine whether these distinctions have been made or not.

Because, for these reasons, a reinterpretation of research with the distinctions introduced by the insight of Zajonc cannot be made,

it would seem necessary to treat with caution any conclusions made on the basis of previous research concerning individual and group learning in programmed investigation. An aim of the present investigation is to begin comparative study of sections of the paradigm (Figure 5).

1.4. Hypotheses of the present investigation

Two study modes from the paradigm of research into group study variables (Figure 5) are considered in the present investigation: individual study in isolation and group study in interaction with other individuals.

At the same time, two different kinds of study materials are used, one with a high proportion of familiar matter (practice programmes on already taught grammatical structures, practice programmes in listening comprehension with already familiar vocabulary and syntax), the other with a high proportion of unfamiliar matter (an introduction to the intonation system of the foreign language concerned).

Through the interaction of these two sets of variables, an attempt is made to incorporate into an experiment with language teaching materials Zajonc's theory of the differentiated effects of group learning and individual learning on the two types of learning task. From this application of the theory to language teaching derive Hypotheses 1 and 2.

Hypothesis 1.
Achievement of subjects studying language materials with a high proportion of familiar matter (practice and revision programmes) will be greater in a condition of group study with interaction than in a condition of individual study in isolation.

Hypothesis 2.
Achievement of subjects studying language materials with a high proportion of unfamiliar matter (new learning) will be greater in a condition of individual study in isolation than in a condition of group study with interaction.

1.5. Definition of central terms

INDIVIDUAL STUDY

Study without communication or contact with other individuals

pursuing the same activity. In this investigation, the activity involved is practice and self-evaluation, mimicry and individual problem-solving with self-instructional language materials. Physical isolation as such is not a necessary part of the concept, but the learning situation involved must be clearly distinguished from that of coaction.

GROUP STUDY

Study in a condition either of coaction or interaction.

COACTION

Study in a community situation without communication between members of the group. Individuals in this situation are pursuing the same activity as other individuals, at the same time and place.

INTERACTION

Study in a group with constant communication between members. The communication involved in this investigation consists of simulated conversation, mutual testing and group problem-solving during work with self-instructional language materials.

2. METHODS

The present investigation took place within the framework of a larger project which investigated the feasibility of self-instruction in university-level English teaching (Black, 1971; Kohonen, 1972). One of the reports on this project (Black, 1971) presents details of the administration and background of the self-instruction project as well as full description of the programmes and tests and an account of the contrastive analyses upon which they were constructed. For this reason, the different sections of this chapter will give only a brief account of administration, test-construction and programme writing.

2.1. Experimental design and statistical methods

The present investigation is a pilot study. It is an a posteriori study of subjects in a non-experimental situation. Subjects were taken from a population of first-year university students following a course of self-instruction in English. The subjects selected for study were:

1. those who had completed all of the self-instructional programmes in a particular area by individual study, the individual study group,
2. those who had attended all of the group-study sessions during which the self-instructional programmes in a particular area were worked through, the group-study group,
3. those who did no study of any kind in a particular area, the contral group.

In each of three areas, Grammatical structures, Listening comprehension, Intonation, the groups were placed in the following design, a variant of Campbell & Stanley's (1963) Design 10:

O_1 $X_{Ind.}$ O_2

O_3 X_{Group} O_4

O_5 $X_{Control}$ O_6

In this design, O_1, O_3 and O_5 are initial performances as

measured by a pre-test, X is treatment and O_2, O_4 and O_6 are performances subsequent to treatment, as measured by a post-test

The statistical technique used with this design was analysis of covariance, taking pre-test scores as covariates. Analysis of covariance is a statistical means of adjusting for the effects of an uncontrolled variable (Ferguson, 1966). The choice of this technique for the present investigation was motivated by the need to allow individual differences, not eliminated by randomization, to be reflected in the design as the pre-test scores (covariate) of all those students who fulfilled the requirements of the three groups.

An alternative to this procedure would have been to take into the groups only those students whose pre-test scores gave matched groups fulfilling the conditions of normal distribution and homogeneity of variance and to perform a one-way analysis of variance on post-test scores. This alternative was rejected, because the matching of subjects who had, for reasons not known to the investigator, selected themselves to a particular treatment group, could well emphasize the effect of these unknown determinants. For example, if a subject had selected group study because of a special aptitude for working with other people, this determinant of his choice would have an effect on his post-test score that was independent of the treatment as such, and matching such a student with others not sharing this attribute would accentuate the effect concerned.

The dependent variables of the investigation are language abilities at completion of instruction. An enquiry was made into attitude at completion of instruction , but as no measurement of initial attitude was taken, these effective variables are not taken into the design of the investigation.

The measures used had been tested on several populations of individuals comparable to those taken into the investigation (university students of English). Kohonen's (1972) study of the group of language tests to which these measures belong has suggested that the distribution of language ability concerned, as measured by these tests, is approximately normal. On this assumption, the ordinal variables yielded by the tests used in this investigation are treated for statistical purposes as interval variables.

To draw conclusions about the hypotheses that would be compatible with an a posteriori design attempting to control for individual differences at outset, a means of statistical comparison of the adjusted means yielded by the analysis of covariance was sought that would yield a complete set of comparisons, that is, of control group and both experimental groups. These requirements are met by Duncan's New multiple range test (Winer,1962).

Improved tables supplied in Edwards (1965) were used in applying this test. Because of the unequal n's in each comparison, the harmonic mean was used in the calculation of the standard error of a single mean(Edwards, 1965).

Statistical hypotheses for each area are:

Grammatical structures

$$H_0 : \mu_{Group} - \mu_{Individual} = 0$$

$$H_1 : \mu_{Group} - \mu_{Individual} > 0$$

Listening comprehension

$$H_0 : \mu_{Group} - \mu_{Individual} = 0$$

$$H_1 : \mu_{Group} - \mu_{Individual} > 0$$

Intonation

$$H_0 : \mu_{Group} - \mu_{Individual} = 0$$

$$H_1 : \mu_{Group} - \mu_{Individual} < 0$$

2.2. Programmes

The investigation uses three different programmes covering different areas of advanced language study, namely:

1. Grammatical structures, an intensive revision and remedial programme on the grammatical structures of English (Black, 1969).

2. Listening comprehension, a self-instructional course in advanced listening comprehension, consisting of recorded extracts of a variety of speech models (dialogues, talks, etc.) in a graded sequence, with graded comprehension exercises (Black, 1974).

3. Intonation, a fully programmed introduction to English intonation for advanced students who have not been taught this aspect of the language in their high school courses (Black, 1972).

The content of these programmes was determined by the language study background of the subjects (first-year students) entering the Department of English at the University of Turku. The subjects were assumed to have a good passive or latent knowledge of English grammar and a large passive or latent stock of learnt vocabulary. On the other hand, they were assumed to have received no instruction in English intonation.

The programmes can accordingly be divided into two groups:

1. programmes with an emphasis on revision and remedial work (Grammatical structures, Listening comprehension), in other words, programmes with a high proportion of familiar matter,

2. programmes with an emphasis on new learning (Intonation), in other words, programmes with a high proportion of unfamiliar matter.

These two groups correspond to the requirements of Hypotheses 1 and 2 (Section 1.4.) and provide the possibility of testing these hypotheses.

2.3. Media

The language laboratory equipment used in the two study conditions differed only as far as the demands of these conditions made necessary. For example, individual study in isolation required isolated, soundproof booths, while group study with interaction required promises where subjects could interact. In other respects, the equipment used in both conditions was identical or closely similar.

Individual study took place in a fully equipped record playback lab. with facilities for individual recording, rewind and replay., individual volume control for programme and student tracks, digital counter, semi-soundproof booths separated by acoustic tilos and glass. Twenty positions were available in one room, four others in an adjoining room, the tape library.

Group study took place in a classroom fitted with audioactive equipment consisting of a control programme source,

individual headphones and microphones with individual control, no separating booths. There were twenty positions.

The microphones and earphones used in both conditions were the same model, and the programme source in each case met equally high standards of fidelity of reproduction (Komiteanmietintö 1972). Equipment was suplied, installed and maintained by the same firm.

It is assumed that the media used in the two conditions are so fully integrated in the study modes concerned that a differentiating effect due tc media alone can with some confidence be excluded.

2.4. Instructional environment

The personnel of the language laboratory co-operated closely in the investigation and ensured that no interference to study came from defective equipment or inadequate supplies of teaching materials. These persons also took care to instruct students working individually, so that they were able to use the equipment confidently and knew where to find the teaching materials they needed.

This attention to the working conditions encountered by students studying individually was highly important to the investigation, since it minimized the effect of a factor one might call organization. This factor favoured work in the group condition in the present investigation, since, in the circumstances of the self-instruction project, individuals working alone were responsible for arranging their own instruction, whereas the group-study subjects had their study organized for them. In spite of the co-operation of the language lab. personnel, this source of error in the investigation can only be claimed to have been mitigated or minimalized.

2.5. Administration

The system of diagnostic testing and self-instruction, including the alternatives of individual and group study, were fully explained to subjects both orally and in a circular (Black, 1971).

A schedule of group-study periods and the time and dates of the first post-tests were announced at the beginning of the experimental period. Subjects chose to study individually, to attend the group-study sessions or not to study at all before presenting themselves for the post-tests. Extra copies of the circular were placed in the language lab. and displayed on notice boards. The personnel of the language lab. and of the Department of English co-operated in ensuring a high level of information.

Library hours were arranged for individual study in the record-playback lab. and extra booths were made available in the tape library, so that facilities were available for individual study at any time during the week. There was no supervision during these library hours; instead, students reported amount of time spent per unit of the programme. This allowed time spent by individuals to be equated with the constant time spent by the group.

The basic pattern of the group-study sessions was that the recorded programme was played to students at fixed intervals, between which headphones were removed and group work begun on the exercises or problems of the printed materials. The nature of this group activity varied according to the nature of the three programmes.

Grammatical structures

The unit was sent from the central console to the students seated in four rows of five, facing the console. Each unit consisted of a dialogue, first heard without pauses, then repeated by the students sentence by sentence, four exercises in a three-phase format (1. cue 2. student response 3. model response), the dialogue again, first heard without pauses, then with pauses after one of the roles for students to insert a free response of their own.

This work was done in chorus (approx. 12 minutes). Group work proper now began, with books. Students removed headsets, turned around and formed groups of fours. The dialogues were rehearsed in alternating pairs, while the exercises were rehearsed by one member of each group in turn asking the others for responses (approx. 20 minutes). The programme was then sent again from the

central source for more chorus work (approx. 12 minutes)

Listening comprehension

The recorded extract was sent from the console to the students facing the console as above. The extract was a passage of five to eight minutes in length. Each student had an answer sheet in front of him. At the end of the extract, headsets were removed and discussion of the comprehension questions followed in groups of four (seven to ten minutes). The extract was then played again, followed by further discussion. In all, the extract was played three times in each session and there were three discussions. The discussions involved comparison of each individual's answers to the comprehension questions and discussion of points involving interpretation of the passage heard.

Intonation

The programme was sent from the console as above, students marking answers to the discrimination frames in their books and producing oral responses to the production frames in chorus. The production frames were isolated sentences illustrating a particular point of intonation or dialogues. At the end of the unit, headsets were removed and groups of four practised the illustrative sentences and dialogues together. The procedure was that one person would read the dialogue and receive criticism from the other members of the group. Following this, roles were reversed. Group work occupied some twenty five minutes of the forty five minute period. Finally, the programme was played again trough the headsets.

Tests on each area were held at times that coincided with the end of a series of group-study sessions in that area, and an announcement was made a week before the group sessions began. The announcement made it possible for persons studying individually to work at the same pace on the group. This could not be controlled, however, so that basically pace of individual work remains a source of uncontrolled variance.

2.6. Teacher participation

Teacher participation was a factor only in the group-study sessions. Here the teacher's role was strictly organisational: distributing printed materials, sending the programme, arranging groups and establishing the pattern of group work described above. In manner, he set out to be pleasant but self-effacing, in order to parallel the human contact experienced by individual workers being served by the lab. personnel.

Requests for information on subject matter, whether from members of groups or from individual workers, were firmly referred to the programmes as the sole source of instruction.

2.7. Tests

The tests, like the whole system of self-instruction, were developed and validated over a whole academic year, 1970-71, at the University of Turku. Native speakers and non-native experts took the tests and offerred criticism. Information was also sought from students passing through the system, and complete computerised analyses with the test analysis programme OPSAM (Mikkonen & Mikkonen, 1971) were performed regularly on different administrations of the test battery (Black, 1971).

The final version of the three tests used in the present investigation, as administered in autumn 1971 to a population of seventy four students entering the Department of English, presented the characteristics displayed in Tables 3, 4 and 5. Table 6 displays intercorrelations between these three tests.

Table 3. Characteristics of Grammatical structures test, autumn 1971 (N = 74)

No. of items	50	
Mean	33.8	
Standard deviation	5.9	
Distribution of scores	43-46	3
	39-42	11
	35-38	23
	31-34	19
	27-30	11
	23-26	4
	19-22	2
	15-18	0
	11-14	1
Reliability	0.80	
Cut-off score	40	

The reliability value is Cronbach's (1951) α-coefficient

Table 4. Characteristics of Listening comprehension test, autumn 1971 (N = 74)

No. of items	33	
Mean	19.73	
Standard deviation	6.14	
Distribution of scores	27-30	14
	23-26	14
	19-22	17
	15-18	16
	11-14	6
	7-10	6
	3-6	1
Reliability	0.87	
Cut-off score	23	

Table 5. Characteristics of Intonation test, autumn 1971 (N = 74)

No. of items	55	
Mean	34.4	
Standard deviation	5.8	
Distribution of scores	44-47	4
	40-43	12
	36-39	15
	32-35	20
	28-31	14
	24-27	7
	20-23	2
Reliability	0.77	
Cut-off score	44	

Table 6. Intercorrelations of the three tests

	Grammatical structures	Intonation
Grammatical structures	-	0.14
Listening comprehension	0.61	0.28

The cut-off scores in Tables 3, 4 and 5 represent the pass-level, or level of mastery, declared acceptable. In order to be given credit for a particular area, students scoring less than the cut-off scores were required to take the test again. They were advised either to pursue individual study or to attend the group-study sessions.

2.8. Measurement of attitude

Attitudes of students participating in the project of self-instruction during 1971-72 were investigated independently of the present investigation by Kohonen (1972), who allowed his primary material to be re-evaluated in the present study. Kohonen's (1972) written questionnaire covered a wide range of attitude: towards tests, programmes, language study and future career envisaged. To incorporate this material into the present investigation, statements were selected from the questionnaire that appeared to have direct relevance to the two experimental treatments.

Seven statements were selected. The scale of response for these was:

1. I disagree strongly.
2. I disagree.
3. I cannot say.
4. I agree.
5. I agree strongly.

The statements selected were:

1. Programmes and tests are interesting.
2. The whole lab. teaching is useless in its present form.
3. Familiarity with this kind of teaching and testing is useful, because it represents a future development in language teaching.
4. Spoken language should be given a more important place in first-year language teaching.
5. The whole system is far too time-consuming.
6. Work on the programmes does not help much in passing the tests.
7. Rigorous pass requirements cause unpleasant test stress.

Since subjects were frequently located in different groups in each of the three areas - for example, a subject might be a member of the control group in Listening comprehension but a member of the individual study group in Intonation - results are given only for those who consistently received the same treatment. This involved a large loss of subjects for the attitude study ($n_{Individual}$ = 10; n_{Group} = 7). It was reasoned that the control group, who

had had no experience of the treatments, could not express meaningful opinion about them. These subjects were thus excluded from the attitude study. Mean scores of the two experimental groups on each statement were compared by means of the t-test.

3. RESULTS

Tables 7, 9 and 11 display results of the analysis of covariance performed on the pre- and post-test scores of subjects in the three groups:

Ind., those who completed all of the programmes by individual study

Group, those who attended all of the group-study sessions

Control, those who did no study of any kind.

Pre-test scores, the covariate, are shown in the tables as the X mean.

The unadjusted post-test scores Yield the Y mean.

Post-test scores adjusted for the effect of the covariate yield the Y mean.

Grammatical structures.

Table 7. Grammatical structures: analysis of covariance of post-test scores with pre-test scores as coveriates

Treatment	N	X mean	Y mean	adjusted Y mean
Ind.	14	32.93	39.14	39.53
Group	7	31.00	41.57	42.98
Control	15	35.60	39.13	38.11

F = 3.56

Since $F_{.95}$ (2.33) = 3.32, the analysis of covariance has revealed significant variance. Inspection of the adjusted Y means indicates that a difference between Group treatment and the other two treatments is the source of this variance.

The statistical hypotheses for this area are:

$$H_0 : \mu \text{ Group} - \mu \text{ Ind.} = 0$$

$$H_1 : \mu \text{ Group} - \mu \text{ Ind.} \neq 0$$

The significance level specified is .05.

Using Duncan'sNew multiple range test, the region of rejection for H_0 is a shortest significant range (R_2) of 3.22 for the comparison C - B (Group - Ind.) in Table 8.

Table 8. Duncan's New multiple range test applied to the difference between adjusted means for Grammatical structures

Means	A Control 38.11	B Ind. 39.53	C Group 42.98	Shortest significant ranges (α = .05)
A 38.11	-	1.43	4.88	R_2 = 3.22
B 39.53	-	-	3.45	R_3 = 3.39

Standard error of a single mean: 1.12

Since the range obtained for the comparison C - B is greater than 3.22, H_0 is rejected at the specified significance level of .05. The other comparisons indicate that the group study subjects made significantly greater gains than controls (the comparison C - A, using R_3), but that the individual study subjects did not (comparison B - A, using R_2).

Figure 6 displays the distributions of each group in the pre- and post-tests.

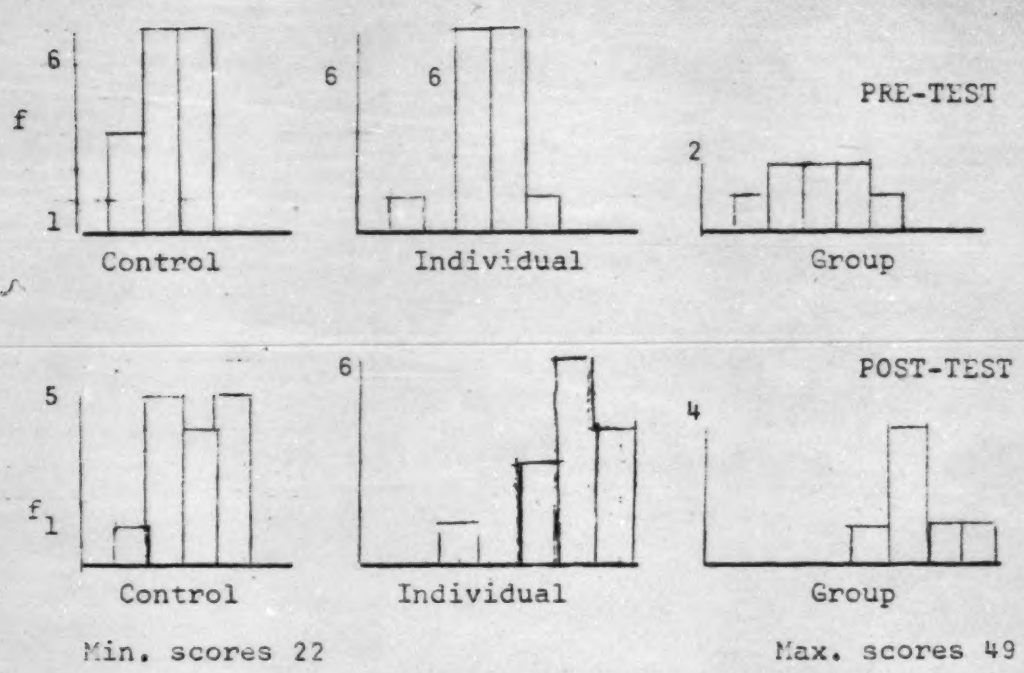


Figure 6. Grammatical Structures: distribution of pre-test and post-test scores

Listening comprehension

Table 9. Listening comprehension: analysis of covariance of post-test scores with pre-test scores as covariates

Treatment	N	X mean	Y mean	adjusted Y mean
Ind.	15	14.87	24.53	25.00
Group	7	15.29	27.43	27.69
Control	7	18.29	21.00	19.74

F = 4.65

Since $F_{.95}$ (2.26) = 3.37, the analysis of covariance has revealed significant variance. Inspection of the adjusted Y means indicates that most of this variance lies between the two experimental treatments on the one hand and the controls on the other. Some portion of the variance, however, is accounted for by the difference between the two experimental treatments

The statistical hypotheses for this area are:

$$HH_0: \mu_{Group} - \mu_{Ind.} = 0$$

$$H_1: \mu_{Group} - \mu_{Ind.} > 0$$

The significance level specified is .05.

Using Duncan's New multiple range test, the region of rejection for H_0 is a shortest significant range (R_2) of 4.80 for the comparison C - B in Table 10.

Table 10. Duncan's new multiple range test applied to the difference between adjusted means for listening comprehension

Means	A Control I 19.74	B Ind. 25.00	C Group 27.69	Shortest significant ranges (α = .05)
A 19.74	-	5.26	7.95	R_2 = 4.80
B 25.00	-	-	2.68	R_3 = 5.05

Standard error of a single mean: 1.65

Since the range obtained for the comparison C - B is less than 4.80, H_0 cannot be rejected at the specified significance level of .05. The other comparisons indicate that both the experimental groups made significantly greater gains than the controls (the comparisons C - A, using R_3 and B - A, using R_2).

Figure 7 displays the distributions of each group in the pre- and post-tests.

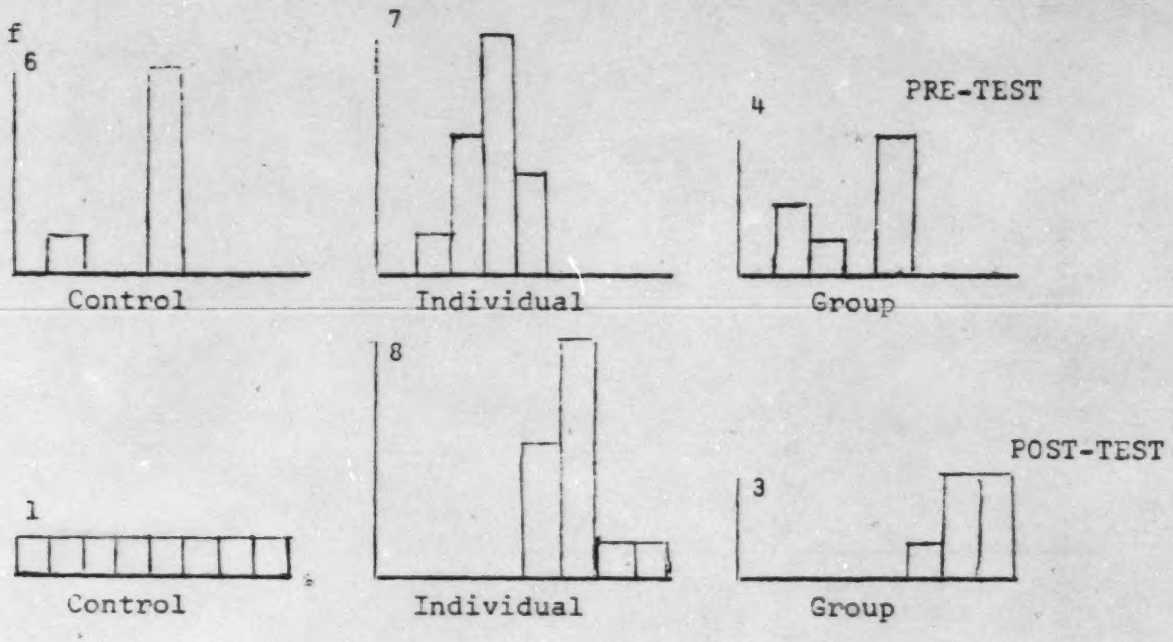


Figure 7. Listening Comprehension: distribution of pre-test and post-test scores

Intonation

Table 11. Intonation: analysis of covariance of post-test scores with pre-test scores as covariate

Treatment	N	X mean	Y mean	adjusted Y mean
Ind.	9	38.89	49.56	49.64
Group	9	39.22	49.78	49.79
Control	7	39.86	43.29	43.16

F = 12.11

Since $F_{.99}$ (2.22) = 5.72, the analysis of covariance has revealed highly significant variance. Inspection of the adjusted Y means indicates that all of this variance lies between the two experimental treatments on the one hand and the controls on the other.

The statistical hypotheses for this area are:

$$H_0 : \mu_{Group} - \mu_{Ind.} = 0$$

$$H_1 : \mu_{Group} - \mu_{Ind.} \neq 0$$

The significance level is .05.

Application of the range test is not needed in this case, since inspection of the means reveals that the group-study mean is even somewhat higher than the individual mean. H_0 cannot be rejected.

Table 12 gives .001 level range values for the other comparisons.

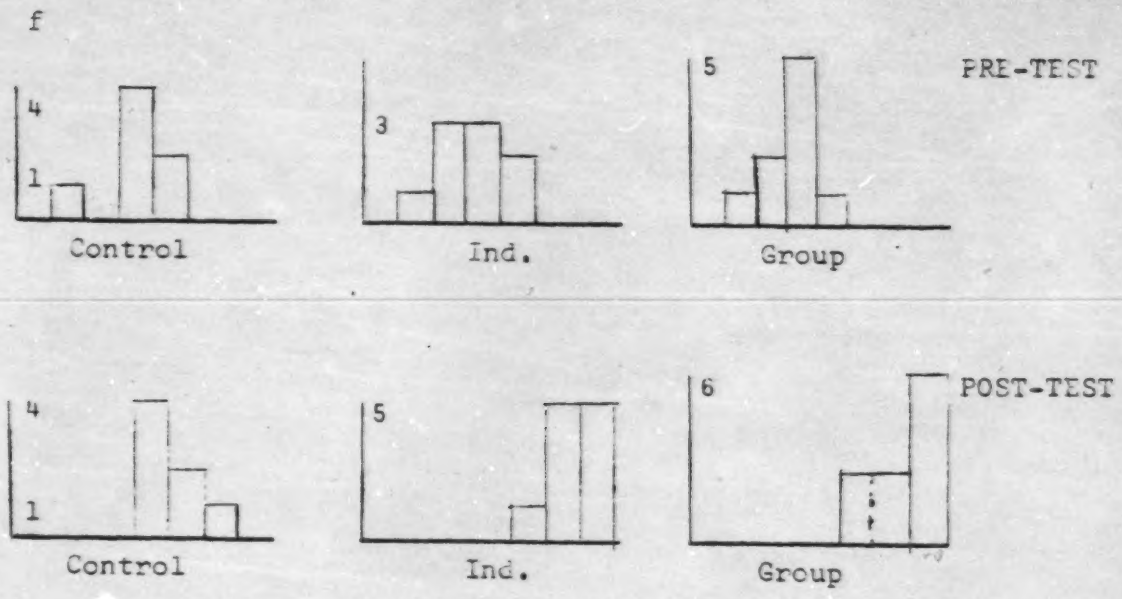
Table 12. Duncan's New multiple range test applied to the difference between adjusted means for Intonation

Means	A Control	B Ind.	C Group	Shortest significant ranges (α = .001)
	43.16	49.64	49.79	
A				
43.16	-	6.48	6.63	R_2 = 4.61
B				
49.64	-	-	0.15	R_3 = 4.80

Standard error of a single mean: 1.04

The comparisons each experimental group and the control group (C - A, using R_3 and B - A, using R_2) indicate that both the experimental groups made significantly greater gains than the controls. This difference was significant at the .001 level.

Figure 8 displays the distribution of each group in the pre- and post-tests.



Min. scores: 31 Max. scores: 54

Figure 8. Intonation: distribution of pre-test and post-test scores

Attitude study

Mean scores of an Individual study group ($n_{Ind.} = 10$) and a Group-study group($n_{Group} = 7$) on the seven selected attitude elicitations are presented below and compared.

Scale 1. disagree strongly - 5. agree strongly

1. "Programmes and tests are interesting."

	Ind.	Group
Mean	3.9	4.14
S.D.	1.1	1.46

t = 0.39

2. "The whole lab. teaching is useless in its present form."

	Ind.	Group
Mean	1.7	2.14
S.D.	0.68	1.07

t = 1.05

3. "Familiarity with this kind of teaching and testing is useful because it represents a future development in language teaching."

	Ind.	Group
Mean	4.3	4.43
S.D.	0.67	0.79

t = 0.361

4. "Spoken language should be given a more important place in first-year language teaching."

	Ind.	Group
Mean	3.9	4.14
S.D.	1.1	1.46

t = 0.39

5. "The whole system is far too time-consuming."

	Ind.	Group
Mean	3.5	2.7
S.D.	1.18	1.38

t = 1.26

6. "Work on the programmes does not help much in passing the tests."

	Ind.	Group
Mean	1.8	2.14
S.D.	1.23	1.21

t = 0.57

7. "Rigorous pass requirements cause unpleasant test stress."

	Ind.	Group
Mean	3.2	3.14
S.D.	1.32	1.21

None of the differences in attitude means between the Individual study group and the Group study-group are significant ($t_{.95}$ = 1.75). On statements 1, 3, 4, 5, and 7, the Group study subjects show a tendency towards more favourable attitudes to the system of instruction.

4. DISCUSSION OF RESULTS AND PROPOSALS FOR FUTURE RESEARCH

The problem of the present investigation is to explore postulated differentiating effects of two study mode variables, group study with interaction and individual study, upon learning with language teaching material of two kinds: practice and revision material on the one hand and material presenting new learning on the other.

The differentiating effects, drawn from a theory of Zajonc (1965, 1966), suggest a superiority for a group study condition in work with practice and revision material (here Grammatical structures and Listening comprehension) and a superiority for

individual study in work with material presenting new learning (here Intonation).

Before any interpretation of the results can be made, some weaknesses of design and administration must be discussed. Because this is an *a posteriori* study without randomization of assignment of groups and treatments, any difference that may be found between post-treatment means is interpretable as:

1. a difference caused by treatments, or
2. a difference caused by other factors.

For example, choice of study mode may have been influenced by ability, students in particular ability ranges choosing particular groups. For this reason, no more can be claimed for the results of this study than that they provide suggestive indications for future research incorporating experimental, randomized investigations. The small numbers of subjects is another reason for hesitating to draw firm conclusions from the present investigation.

Two features of administration have already been mentioned (Sections 2.4. and 2.5.) as possible sources of uncontrolled variance. The first of these is the "organisation factor": individual study subjects were responsible in this study for finding their own materials and setting up their own lab. positions. It can be assumed that the possible effects of this factor were very largely mitigated by the close attention paid to the individual study students by the personnel of the language lab. Nevertheless this remains an uncontrolled variable. Control could be arranged by having individual study scheduled for certain times at which assistance would always be available. This is difficult in terms of the present problem, as it is necessary to avoid a situation where students are working simultaneously (in coaction).

The second, a more serious potential source of variance, is the pace or intensity with which individuals worked through the programmes. In an attempt to stabilize this factor, the post-test for a particular area was announced just before group-study in that area began, so that individuals were more likely to follow the pace of the group than would otherwise have been the case. This is not an adecuate control. Control could be

arranged by fixed scheduling of individual study and by securing a report on times and dates on which work on particular programmes was done.

With these reservations in mind, a cautious interpretation of the results of the investigation can now be attempted.

Hypothesis 1.

> Achievement of subjects studying language materials with a high proportion of familiar matter (practice and revision programmes) will be greater in a condition of group study with interaction than in a condition of individual study in isolation.

Support was given to this hypothesis by the results for the Grammatical structures programme, which show a superiority for the group-study treatment (Tables 7 and 8). The superiority of the group-study subjects is given additional weight by the fact that individual study subjects failed to show significant gains in comparison to the controls, whereas the group-study subjects did show significantly greater gains.

Although results for the listening comprehension programme do not support Hypothesis 1 at the specified level of significance, a trend similar to the results for the Grammatical Structures programme can be seen (Tables 9 and 10).

Hypotheses 2.

> Achievement of subjects studying language materials with a high proportion of unfamiliar matter (new learning) will be greater in a condition of individual study in isolation than in a condition of group study with interaction.

This hypothesis was not given support by results for the Intonation programme (Tables 11 and 12). Both experimental treatments show highly significant gains in comparison with the controls, but the very small difference between the adjusted means of the two groups actually favours the group-study condition.

In addition to the caution which must be exercised in interpreting all the results of this pilot study, there is special cause here to suspend judgement on Hypothesis 2.

The unadjusted Y means of Table 11, the means of the post-test scores, of both experimental groups (Group: 49.78, Ind.: 49.56) lie close to the absolute maximum score of the test (55). This suggests that a ceiling effect may have intervened to obscure the real variance between the groups. Compare in this respect the distribution of the post-test scores (Figure 8). It is clear that in a future investigation this test must be modified to show more variance in higher scores, i.e. by made more difficult.

It remains therefore to conduct further investigation of Hypothesis 2. It can be remarked, however, notwithstanding the technical deficiencies of the post-test, that the Group-study subjects performed surprisingly well in view of the direction of the hypothesis. If a more rigorous investigation should confirm this trend, an alternative hypothesis could be considered, namely:

> Achievement of subjects studying language materials with a high proportion of unfamiliar matter (new learning) is the same in a condition of individual study in isolation and in a condition of group study with interaction.

This alternative hypothesis would take the investigation outside the theoretical postulates of the present study. It would imply that for new learning, the choice between these study modes is immaterial, but that for revision or remedial work, group-study with interaction is preferable. Remedial work - unlearning one's errors - is known to be more difficult than new learning, and it may be that group study has a special role to play here.

Attitude study

The results of the assessment of attitude, in which the group-study subjects showed a tendency only towards more favourable attitudes towards instruction and learning environment, are unsatisfactory for the following reasons:

1. A large loss of subjects occurred because of the location of individuals in different experimental groups across the three areas. This was a consequence both of the free administration of the self-instructional system and of the generalnature of the questionnaire , which covered all areas together.

2. The point of time at which the questionnaire was administered was after conclusion of treatment and after results of the post-test had been announced. This allows two possible sources of attitude difference: attitude change due to treatments, attitude change due to knowledge of results.

3. No assessment of attitude was made before treatments began.

4. Questions of relevance to the present investigation were not asked. For example, "Would you have preferred to work (a) in a group (b) alone (c) in an ordinary classroom?"

5. The language of the questions was complicated. Several of them contained double negatives and involved the subject in difficult decision problems. For example, "The ... teaching is useless ..." and "The whole system is ... time-consuming" are concealed negations, so that when the subject is asked whether he disagrees with them, he must sort outta relatively complex decision. A likely consequence is a careless response.

Recommendations for future investigations

It is of great importance for the interpretation of future investigations in this field that the assessment of attitude be closely combined with the investigation of achievement on the programmes. In this way, information can be gained that will contribute to an explanation of differences between the achievement of treatment groups. Accordingly, the following design is proposed as a model of a future investigation of each of the three language ability areas.

Using an experimental design, a variant of Campbell & Stanley's (1963) Design 4, a random sample of x individuals will be taken from a university population of first-year students of English. A pre-test will be given to the sample, and on the basis of pre-test scores subjects will be paired, one of each pair being assigned randomly to Treatment 1 (individual study)

The design is:

$$R \quad O_1 - X_{Ind.} - O_2$$

$$R \quad O_3 - X_{Group} - O_4$$

in which R = randomization
O_1 and O_3 = initial performances as measured by the pre-test,
X = treatment,
O_2 and O_4 = performances subsequent to treatment as measured by the post-test.

It is not proposed to include a control group, as the pilot study appears to have provided a sufficient indication of the size of treatment effects relative to that of simple maturation. The study of Kohonen (1972) on the same teaching materials also supports the decision.

The reason for pairing in the design is to allow for the possible effects of an interview that will be used, in addition to a written questionnaire, to obtain a maximum of information from the subjects. The interview will be conducted during treatments, whereas the written questionnaire will be administered before and after treatments. The interviewer will be a person other than the investigator, speaking the native language of the subjects. Major areas of attitudinal measurement in the questionnaire and interview will be:

1. attitude towards the teaching materials
2. attitude towards the treatments
3. attitude towards language learning
4. attitude towards the English language and Anglo-Saxon culture.

Since it is postulated that the interview may itself constitute a significant factor in the total learning situation, the experimental design will include parallel interview and non-interview groups of matched pairs. In these groups, one member of each matched pair will have been assigned to individual study, the other to group study (Figure9).

	Interview	Non-interview
Individual	$O_1 - (X + i) - O_2$	$O_1' - X - O_2'$
Group study	$O_3 - (X + i) - O_4$	$O_3' - X - O_4'$

Figure 9. Matched pairs design for the investigation of effect of interview

Both interview and non-interview groups will receive the written questionnaire before and after treatment.

Since matching by pairs across treatment groups will have been carried out during formation of the experimental groups, the possible effects of interview can be investigated as a two-factor experiment with repeated measures on one factor. For this purpose, it is postulated that the two members of each pair are equivalent to one subject on which two measures are taken on a factor B (b_1 = individual study, b_2 = group study). The second factor in the experiment is interview (a_1 = interview; a_2 = non-interview). This design is displayed in Figure 10.

	b_1	b_2
a_1	G_1	G_1
a_2	G_2	G_2

Figure 10. Design of a two-factor experiment with repeated measures on Factor B (study mode)

G_1 in Figure 10 represents a group of n subjects observed under the treatment combinations ab_{11} and ab_{12}, while G_2 represents another group of n subjects observed under the conditions ab_{21} and ab_{22} (Winer, 1962).

Figure 11 displays the form of an analysis of variance to be performed on the two-factor experimental data.

Source of variation
Between subjects
A (interview/non-interview)
Subjects within groups
Within subjects
B (individual study/group study)
AB
B x subjects within groups

Figure 11. Analysis of variance on post-test scores in the two-factor experiment

If either interview/non-interview or interaction of treatment and interview/non-interview is shown to be a significant source of variance, an attempt will be made to interpret the findings with the aid of information yielded by the interview. If this is not the case, the interview and non-interview sub-groups in each treatment group will be combined, and a comparison of post-test scores made using a t-test for paired comparisons.

SUMMARY

In discussion and investigation of group study in the fields of language teaching and programmed learning, little attention has been paid to the re-interpretation by Zajonc (1965, 1966) of the older literature on social facilitation. Zajonc noted that both the presence of an audience and coaction with other individuals facilitate performance of well-learned responses, whereas the learning of new responses is best achieved in isolation.

This insight has particular relevance to language teaching in the language laboratory, since there is some confusion as to the function of individual and group study with this medium.

The present investigation distinguishes four categories:

1. study in isolation
2. study in front of an audience
3. study in coaction with other individuals
4. study in interaction with other individuals.

Two of these, study in isolation and study in interaction are the subject of the investigation.

Across the study mode variables,, two different kinds of study materials are investigated:

1. material with a high proportion of familiar matter (practice programmes in already taught grammatical structures, practice programmes in listening comprehension with already familiar vocabulary and syntax)
2. material with a high proportion of unfamiliar matter (an introduction to the intonation system of the foreign language concerned)

Through the interaction of these two sets of variables, an attempt is made to incorporate into an investigation with language teaching Zajonc's theory of the differentiated effects of group learning and individual learning on the two types of learning task. From this application of the theory to language teaching derive Hypotheses 1 and 2.

Hypothesis 1.

> Achievement of subjects studying language materials with a high proportion of familiar matter ((practice and revision programmes) will be greater in a condition of group study with interaction than in a condition of individual study in isolation.

Hypothesis 2.

> Achievement of subjects studying language materials with a high proportion of unfamiliar matter (new learning) will be greater in a condition of individual study in isolation than in a condition of group study with interaction.

The investigation is an a posteriori study of subjects in a non-experimental situation. Subjects were taken from a population of first-year students at the University of Turku following a course of self-instruction in oral-aural English. These selected for study were:

1. those who had completed all of the self-instructional programmes in a particular linguistic area by individual study (the Individual study group)

2. those who had attended all of the group-study sessions during which the self-instructional programmes were worked through (the Group-study group)

3. those who did no study of any kind in a particular area (the Control group).

Subjects were given a pre-test and a post-test during the course of the self-instructional project. Analysis of covariance, taking pre-test scores as covariates, was applied to pre- and post-test scores in each linguistic area. The adjusted means of Control, Group-study and Individual groups were compared (Tables 7-12).

In the Grammatical structures area, Group-study subjects showed a significant superiority over the Individual study subjects, and there was a similar tendency, though not a significant difference, in the listening comprehension area. The result suggests confirmation of Hypothesis 1.

In the Intonation area, Individual subjects did not show any superiority over Group study subjects, so that Hypothesis 2 could not be confirmed.

A limited attitude study gave some suggestion of more favourable attitudes towards instruction in the Group-study subjects.

An experimental design, linked to attitude study, is proposed for further investigation of the problem.

REFERENCES

Ager, D.E., Advanced students in the language laboratory. Visual Education, (1970), 13-15.

Allan, J. & Richardson, R.H., Programmed learning: a multi-media approach. In APL-NCPL Programmed Learning Conference. Proceedings. London 1967.

Allport, F.H., The influence of the group upon association and thought. Journal of Experimental Psychology, 3 (1920), 159-182.

Allport, F.H., Social Psychology. Boston 1924.

Amaria, R.P., Learning in pairs. In APL-NCPL Programmed Learning Conference. Proceedings. London 1967.

Amaria, R.P., Biran, L.A., & Leight, G.O.N., Individual versus co-operative learning, 1: influence of intelligence and sex. Educational Research, 11 (1969), 95-103.

Amaria, R.P., Biran, L.A., & Leight, G.O.N., Individual versus co-operative learning, 2: influence of personality. Educational Research, 11 (1969b), 193-199.

Amaria, R.P., Biran, L.A., & Leight. G.O.N., Learning in pairs. Research Notes on Programmed Learning, 10, 1966.

Austwick, K., Research report. New Education, 1 (1965), 25-26.

Ausubel, D.P., Adults versus children in second language learning: psychological considerations. Modern Language Journal, 48 (1964), 420-424.

Bales, R.F., Interaction process analysis. Cambridge, Mass., 1950.

Bauer, E.W., A study of the effectiveness of two language laboratory conditions in the teaching of second-year German. IRAL, 2 (1964), 99-112.

Black, C., Advanced listening comprehension, London 1974.

Black, C., Practising English. Helsinki 1969.

Black, C., Practising English intonation. Helsinki 1972.

Black, C., The University language laboratory: diagnostic testing and self-instruction. Publications of the Department of English, University of Turku, 1, 1971.

Bloomfield, I., Language. New York 1933.

Brooks, N., Language and language learning: theory and practice. New York 1960.

Brown, J.I., Where programmed instruction fits - a study of attitudes to group pacing. NSPI Journal, 4 (1965), 15-19.

Bung, K., Die Funktion des Lehrers im programmierten Sprachunterricht. Programmiertes Lernen, 8 (1971), 19-35.

Bung, K., Language laboratory work for advanced students and the "Audio-Adapter". In K. Bung (Ed.), 1967, 226-228.

Bung, K. (Ed.), Programmed learning and the language laboratory, 2. London 1967.

Campbell, D.T. & Stanley, J.C., Experimental and quasi-experimental designs for research on teaching. In N.L. Gage (Ed.), 1963, 171-246.

Carpenter, C.R. & Greenhill, L.P. (Eds.), Comparative research on methods and media for presenting courses in mathematics and English. Pennsylvania State University 1963.

Carroll, J.P., Contributions of psychological theory and educational research to the teaching of foreign languages. In A. Valdman (Ed.), 1966, 93-106.

Carrol, J.B., What does the Pennsylvania Foreign Language Project tell us? Foreign Language Annals, 3 (1969), 2-5.

Chastain, K., The development of modern language skills: theory to practice. Philadelphia 1971.

Chomsky, N., Cartesian linguistics. New York 1966.

Chomsky, N., A review of Verbal Behavior by B.F. Skinner. Language, 25 (1959), 26-58.

Chomsky, N., Syntactic structures. The Hague 1957.

Coulsen, J.E. (Ed.), Programmed learning and computerbased instruction. New York 1962. Crist, R.L., Use of a programmed multiplication text under group-paced and individual-paced conditions. Audio-Visual Communication Review, 14 (1966), 507-513.

Cronbach, L., Coefficient alpha and the internal structure of tests. Psychometrica, 16 (1951), 297-334.

Dashiell, J.F., An experimental analysis of some group effects. Journal of Abnormal and Social Psychology, 25 (1930), 190-199.

Dick, W., Retention as a function of paired and individual use of programmed instruction. Journal of Programmed Instruction, 2/3 (1963), 17-23.

Dodd, B., Programmed learning against the clock. New Education, 1 (1965), 37-38.

Edwards, A.L., Experimental design in psychological research. New York 1965.

Feldhusen, J.F. & Birt, A., A study of nine methods of presentation of programmed learning material. Journal of Educational Research, 55 (1962), 461-466.

Fellows, B.J. & Apter, M.J., An experimental study of three variables in the presentation of audio-visual teaching programs. Programmed Learning and Educational Technology, 4 (1967), 19-28.

Ferguson, G.A., Statistical analysis in psychology and education. New York 1966.

Freudenstein, R., Ein Sprachlaborfur das Gymnasium. Programmiertes Lernen, 2 (1965), 26-30.

Frye, C.H., Group versus individual pacing in programmed instruction. Disserdation Abstracts, 25 (1964), 1440.

Gage, N.L. (Ed.), Handbook of research on teaching. Chicago 1963.

Gallegos, A.M., A study and comparison of experimenter pacing and student pacing of programmed instruction. Dissertation Abstracts, 27 (1966), 702 A.

Greenhill, L.P., Lottes, J.J. & Pagano, A., Adaptation and evaluation of a programmed mathematics course for television presentation. In C.R. Carpenter & L.P. Greenhill (Eds.), 1963.

Gropper, G.L. & Kress. G., Individualizing instruction through pacing procedures. Audio-Visual Communications Review, 13 (1965, 165-182.

Harris, Z., Methods in structural linguistics. Chicago 1951.

Hartley, J. & Cook, A., Programmed learning in pairs: the results of miniature experiments. Programmed learning and Educational Technology, 4 (1967), 168-178.

Hartley, J. & Hogarth, F.W., Programmed learning in pairs. Educational Research, 13 (1971), 130-134.

Heimer, R.T., Comparison of external-pacing and self-pacing of programmed instruction in mathematics, using different methods of presentation. In C.R. Carpenter & L.P. Greenhill (Eds.), 1963.

Heuser, I. & Messelken, H., Zur Effektivität von Sprachlaborsystemen. Das Sprachlabor und der audiovisueller Unterricht, 2 (1968), 45-50.

Heymen, M. & Boegkmann, K., Vergleich der Wirkungsweise audiovisueller Lehrprogramme in Einzel-, Parallel- und Gruppenschulung. Programmiertes Lernen, 2 (1972), 92-112.

Hirzel, M., Partnerarbeit in programmierten Unterricht. Stuttgart 1969.

Hogarth, F.W. & Hartley, J., Mixed ability versus ownchoice pairs. Programmed Learning and Educational Technology,10 (1973),69-76.

Hulteen, C. & Crist, R.L., The group use of programmed instructional materials. Programmed Learning and Educational Technology, 6 (1969), 4-11.

Husband, R.W., Analysis of methods in human maze learning. Journal of Genetical Psychology, 39 (1931), 258-277.

Jones, C.W., A programmed management course - individual versus group administration.. Department of Occupational Psychology. Birkbeck College, 1964.

Keil, K.J., Noch eimmal: das Sprachlabor fur Gruppenarbeit. Programmiertes Lernen, 3 (1966), 27-28.

Keislar, E.R. & McNeil, J.D., Teaching science and mathematics by auto instruction in the primary grades: an experimental study in curriculum development. In J.E. Coulsen (Ed.), 1962, 99-112.

King, F.E., Mathieu, G. & Holton, J.P., Sound language teaching: the state of the art today. . New York 1961.

Kohonen, V., The University language laboratory: experimental findings. Publications of the Department of English, University of Turku, 3, 1972.

Komiteanmietintö 1971: A 11. Korkeakoulutasoisen kielistudio-opetuksen yleistä kehitystä suunnittelevan toimikunnan mietintö 1: ohjeita kielistudioiden suunnittelusta, mitoituksesta ja käytöstä. Helsinki 1971.

Lado, R., Language teaching, a scientific approach. New York 1964.

Lewis, J.T., A study of pacing rate and mode of presentation in programmed instruction. Dissertation Abstracts, 25 (1965), 649.

Lorge, S.W., Language laboratory research studies in New York City high schools: a discussion of the program and the findings. Modern Language Journal, 46 (1964), 409-419.

Lottes, J.J., Palmer, G. & Oakes, L., An experimental comparison of differential rates of pacing programmed mathematics. In C.R. Carpenter & L.P. Greenhill (Eds.), 1963.

Lumsdaine, A.A. & Glaser, R. (Eds.), Teaching machines and programmed learning I. Washington 1960.

Matthes, M., Gruppenarbeit in Englishunterricht der Unterstufe. Die Neueren Sprachen, 68 (1969), 29-39.

Mengler, K., Gruppenarbeit im fremsprachlichen Anfangsunterricht. Praxis des neusprachlichen Unterrichts, 19 (1972), 398-409.

Messner, D., Ein Kommunikationsmodell fur den Fremdsprachenunterricht. Das Sprachlabor und der audio-visuelle Unterricht, 3 (1968), 94-99.

Mikkonen, V. & Mikkonen, J., OPSAM: opintosaavutusten mittaus. Helsinki 1971.

Moore, D.L., Group teaching by programmed instruction. Programmed Learning and Educational Technology, 4 (1967), 37-46.

Morton, F.R., The language lab. as a teaching machine: notes on the mechanization of language teaching. Ann Arbor, 1960.

Morton, F.R., The Lindenwood experiment. New York 1965.

Mueller, K.A. & Wiersma, W., The effects of language laboratory type upon cultural orientation scores of foreign language students. Modern Language Journal, 51 (1967a), 258-263.

Mueller, K.A. & Wiersma, W., The effects of language laboratory type upon foreign language achievement scores. Modern Language Journal, 51 (1967b), 349-351.

Mueller, T.H., The effectiveness of two learning models: the audio-lingual habit theory and the cognitive code-learning theory. In P. Pimslour & T. Quinn (Eds.), 1971, 113-122.

National Centre for programmed Learning. A comparison of individual and group-paced programmed learning. Birmingham 1968.

Noble, G., A study of the differences between paired and individual learning from a branching program. Programmed Learning and Educational Technology, 4 (1967), 108-112.

Oldfield, W.J., Individual versus group methods in programmed instruction. Research Reports in Programmed Learning, 1. Birmingham 1964.

Oller, J.W., Language communication and second language learning. In P. Pimsleur & T. Quinn (Eds., 1971, 171-179.

Oller, J.W. & Obrecht, D.H., Pattern drill and communicative activity: a psycholinguistic experiment. IRAL, 6 (1968), 165-174.

Paivio, A., Imagery and verbal processes. New York 1971.

Pessin, J., The comparative effects of social and mechanical stimulation on memorizing. American Journal of Psychology, 45 (1933), 263-270.

Pimsleur, P. & Quinn, T., The psychology of second language learning: papers from the Second International Congress of Applied Linguistics. Cambridge 1971.

Polak, M., An experiment in group work. English Language Teaching, 17 (1964), 112-117.

Rivers, W.M., Teaching foreign-language skills. Chicago 1968.

Sawiris, M.Y., An experimental study of individual and group learning using a linear geometry programme. Programmed Learning and Educational Technology, 3 (1966), 146-153.

Sawiris, M.Y., A study of interaction in small instructional groups. Educational Review, 19 (1966b), 51-64.

Schommartz, W., Arbeitsgemeinschaften in Sprachlabor. Englisch, 7 (1972), 48-52.

Silverman, R.E. & Alter, M., response mode, pacing and motivational factors in teaching machines. Programmed instruction, 1 (1961), 7.

Skinner, B.F., Teaching machines. In A.A. Lumsdaine & R. Glaser (Eds.), 1960, 137-158.

Skinner, B.F., Verbal behavior. New York 1957.

Smith, P.D., A comparison of the cognitive and audio-lingual approaches to foreign language instruction: The Pennsylvania Foreign Language Project. Philadelphia 1970.

Smith, W.F., The language laboratory and the electronic classroom: a comparison of their relative contribution to achievement in three languages in the comprehensive high school. Unpublished Th.D. Dissertation, Purdun University 1969.

Spolsky, B., A psycholinguistic critique of programmed foreign language instruction. IRAL, 4 (1966), 119-127.

Stack, E.M., Laboratories: the effectiveness controversy. Modern Language Journal, 48 (1964), 189-194.

Strittmatter, P., Präsentationsmodi von Lehrprogrammen. Weinheim 1970.

Sutter, E.G. & Reid, J.B., Learner variables and interpersonal conditions in computer-assisted instruction. Journal of Educational Psychology, 60 (1969), 153-157.

Travis, L.E., The effect of a small audience upon eye-hand coordination. Journal of Abnormal and Social Psychology, 20 (1924), 142-146.

Triplett, N., The dynamogenic factor in pacemaking and competition. American Journal of Psychology, 2 (1898).

Valdman, A. (Ed.), Trends in language teaching. New York 1966.

Winer, B.J., Statistical principles in experimental design. New York 1962.

Wisnikow, R., Für und wieder das Gruppensprachlabor. Programmiertes Lernen. 2 (1965), 119-123.

Zajonc, R.B., Social psychology: an experimental approach. Belmont 1966.

Zajonc, R.B., Social facilitation. Science, 149 (1965), 269-274.